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## BI-MONTHLY PROGRESS REPORT

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## CURRENT ACTIVITIES

### ATLANTIC PROVINCES

**Aerial Spraying Against Spruce Budworm in New Brunswick—1957.**— Spraying in 1957 was on the largest scale ever undertaken against this insect. This was necessary largely owing to a widespread deterioration in the vitality of host stands following the unusually severe 1956 season, coupled with prospects of generally severe attack again in 1957. (Bi-Mo. Prog. Rept. 13(3), 1957). Approximately 5.2 million acres were sprayed with a single application at the average emitted dose of  $\frac{1}{2}$  lb. DDT per acre. This raised the total area sprayed in the six years of the New Brunswick program to 11.4 million acres and the total insecticide to 6 million gallons. The areas sprayed in 1957 included all those previously sprayed plus 0.7 million acres of new high hazard along the south and southwest boundaries. To date, 14% of the total area has been sprayed once, 55.5% twice, 28% three times and 2.5% four times in six years. Each operation has been based on the same policy—to restrict treatment to those areas of high hazard where a year's further delay would seriously threaten the life of host trees. Thus, sprayed areas have represented only 6%, 25%, 14%, 14%, 19% and 40%, respectively, of the total area of the severe attack in New Brunswick in the years 1952 to 1957.

Operations were carried out from 14 airstrips of which two, Grog and MacFarlane, were newly constructed the previous fall. The aerial fleet consisted of 200 Stearman spray planes and 23 Cessna single-engine observation planes. The insecticide, consisting of 1 lb. technical grade DDT in 1 U.S. gallon oil solvent (Picco Hi-Solv 473) was formulated by Forest Protection Ltd. in a plant constructed for the purpose at Dalhousie, N.B. Costs, which averaged about 70¢. per acre, were again shared in equal thirds by Canada, New Brunswick, and landowners and leaseholders.

Seasonal development in 1957 was somewhat delayed by comparison with most other years but was less retarded and less erratic than in 1956. Spraying commenced on June 3 in the earliest areas along the Miramichi Valley and was completed in the northwestern and north-central highlands on July 4. Timing of operations from the 14 airstrips was based on a map of phenological development for northern and central New Brunswick developed for the purpose in the prespray period. A series of early-season flights were made to observe the occurrence of some of the more obvious seasonal phenomena in various parts of the region. Events that proved most useful included the disappearance of ice and snow and the first signs of foliation on certain forest types. The final map, which was checked as far as possible from the ground, consisted of a series of phenocontours drawn to represent approximate successive differences of 2 to 3 days between the earliest areas in the south to the most retarded areas at higher altitudes farther north (*Pulp and Paper Mag. Can.* 59 (C): 301-8, 1958).

Experience has shown that the highest prespray populations are mostly commonly found in new areas of severe attack where host trees still retain a good complement of foliage. In some areas of new high hazard along the western boundary, severe bud-mining coupled with some bud-killing by late spring frosts destroyed most of the new growth before the shoots opened. This precluded effective foliage protection by spraying. Fairly extensive moderate to severe frost damage was also observed at a number of locations in older sprayed areas. These included areas at the headwaters of the Renous River and in parts of the Tobique, Upsalquitch, and Restigouche Watersheds.

Immediate results in terms of insect reduction and foliage preservation may be gauged from the results on permanent plots and from an extensive survey of the area at large involving 497 samples in sprayed areas and 61 in surrounding unsprayed areas. Except in unsprayed check areas all permanent plots were sprayed or affected by drift in both 1956 and 1957. Despite this, third-instar prespray populations

averaged 13.6 larvae per 18-inch branch—sufficient to cause severe damage to the foliage crop that is now being produced in the older outbreak areas by trees that have been weakened by repeated attacks. Compared to this, populations on the Ritchie Brook check plots averaged 15.6 larvae per 18-inch branch after four years of severe attack. On the Charlo check area, average prespray population was 4.5 on surviving trees in stands that are largely dead or dying. Postspray populations, both on the permanent sprayed plots and at the survey locations, averaged 1.1 budworms per 18-inch branch. This was a reduction of 92% from the mean prespray level on permanent plots and was 85% less than surviving populations at surrounding unsprayed survey locations. These percentages fall within the range of results obtained in previous years using the present techniques and dosage. A better indication of improved results in 1957 is that average survival in sprayed areas was much lower—1.1 budworms per branch compared to 2.0 in 1955 and 2.1 in 1956. Evidence that good coverage was achieved is shown in the fact that the average survival in surrounding unsprayed areas was equalled or exceeded at only 1.5% of all sampling locations in sprayed areas.

Current foliage loss in unsprayed areas varied from 33% of the sparse crop in the Charlo check area to 100% on the Ritchie Brook check area. In areas immediately surrounding the sprayed area, current defoliation averaged 84%, but in sprayed areas it averaged only 44%. The apparent net preservation of about 40% of the foliage crop compares favourably with good results in previous years and is a significant improvement over 1956.

Generally good spraying results were followed by a notable decline in reinfestation in sprayed areas and in unsprayed areas to the north and northwest. This was determined from an intensive egg-mass/defoliation survey of the entire Province carried out by personnel of this Division assisted by sampling crews provided by Forest Protection Ltd. Estimates of defoliation and damage were obtained at nearly 3000 locations, mostly spaced at 1-mile intervals along forest roads. Egg counts were obtained at about every third defoliation sampling point. The results are synopsisized in the following table, which compares mean egg-mass numbers per 100 sq. ft. of branch area in 1956 and 1957. Some idea of the hazard represented by these estimates can be gained from the fact that a population of about 240 egg masses per 100 sq. ft. is considered necessary to cause "severe defoliation" (70% or greater loss of new growth) in the early stages of an outbreak, or that 100 egg masses

MEAN NUMBER OF EGG MASSES PER 100 SQ. FT.  
BRANCH AREA NEW BRUNSWICK, 1957

Outbreak Quadrant	Unsprayed Areas			Sprayed Areas		
	1956	1957	% Decline	1956	1957	% Decline
NW.....	218	55	75%	102	60	41%
NE.....	471	79	83	252	58	77
SW.....	182	265	-46	120	55	54
SE.....	395	257	35	257	61	76

are expected to cause about 33% loss of new growth. (Bi-Mo. Prog. Rept. 14(1), 1958). Even when allowance is made for the increased hazard in weakened trees it is evident that defoliation in 1958 should be mainly light in sprayed areas and in the northern unsprayed areas. In unsprayed areas to the southeast, populations were still high enough to forecast severe attack despite a decline of about  $\frac{1}{4}$  from 1956. The heaviest damage in this region is likely to occur in the susceptible stands east of Highway 33 in Kent and Northumberland Counties. The only area in which the



outbreak appears to have intensified in the southwest. Particularly severe attack is likely in an area in York County between Highway 24 and the Grand Falls-Chipman railway, extending northward into Carleton and Victoria Counties to the Tobique River.

The widespread reduction of infestation in New Brunswick for 1958 can doubtless be attributed in part to the very extensive coverage of spraying in 1957. Other factors are also involved, however. Weather systems conducive to large-scale moth migrations occurred relatively infrequently in the flight period and for the first time infestation boundaries along the southern forefront of the outbreak show practically no change. In addition to this, northern parts of the New Brunswick outbreak appear to have been affected in some degree by the same slackening in outbreak intensity that has been reported from adjacent areas in Quebec (Blais, J. R. Bi-Mo. Prog. Rept. 14(1), 1958). However, since the most likely explanation for this involves generally unfavourable weather conditions for the growth and survival of the budworm in the 1956-57 generation, there is yet no reason to believe that the decline will be lasting.

The postspray survey counts showed that other defoliators were about 5% as abundant as the spruce budworm on balsam fir in unsprayed areas and were reduced by an estimated 63% in sprayed areas. As in 1955 and 1956 the most commonly-occurring species was *Griselda radicans* Wlsh. followed by *Eucordylea* sp. and *Diorcystria reniculella* (Grote). Spruce budworm parasites were found in widely-varying numbers in unsprayed areas. *Glypta fumiferanae* (Vier.) occurred most commonly in the southeast and southwest unsprayed areas but *Apanteles fumiferanae* Vier. was the most abundant species in northern unsprayed areas. *Meteorus trachynotus* Vier. and dipterous parasites again occurred in relatively small numbers. *Glypta* averaged 79% less abundant in sprayed than in unsprayed areas whereas *Apanteles*, previously noted to be the less severely affected, was 51% less abundant. Probably largely because of the differential effect of spraying on these two parasites. *Apanteles* was the more abundant survivor in 11 of the 14 airstrip areas. Considering total numbers, parasites were most abundant in the southeast and southwest peripheral areas where the ratio of parasite cocoons and puparia to budworms on the sample branches was 1:3 and 1:4.5, respectively. In the northern unsprayed areas, the ratio averaged 1:10. In sprayed areas it averaged 1:32. Predacious insects were found most abundantly in the southeast unsprayed samples and least frequently in the north. Average predator: budworm ratios were 1:17 in unsprayed areas and 1:7 in sprayed areas. This evidence of higher proportional survival in sprayed areas is also in agreement with results in previous years. Coccinellids were again the most frequently-found predators over the area at large, although spiders occurred with exceptional frequency in southeastern unsprayed areas. Aphids were noted in 24% of sprayed samples and in 11% of unsprayed samples. However, total numbers were small in both cases and it is doubtful whether this difference should be attributed to the effects of spraying. Populations of mites were also inconsequential in both areas.

The low-level, line-strip aerial surveying technique was employed in 1957 to map light, moderate, and severe current attack in unsprayed parts of the Province. Parallel east-west flight lines were flown at intervals of 3 to 10 miles, depending on the intensity of outbreak. This required 45 hours' flying. In sprayed areas, a more intensive survey requiring 355 hours involved a detailed, low-level examination of each of nearly 1200 spray blocks. This was carried out almost exclusively by Forest Protection Ltd. Data recorded included stand type, current and previous defoliation, and an assessment of total hazard in five categories. Conditions of low to moderate hazard, where no mortality was evident and where further spraying will be warranted only with heavy reinfestation, were tallied for nearly three quarters of all sprayed areas. High hazard, including severely defoliated stands with extensive top-killing and some incipient mortality of fir, totalled 1.2 million acres in sprayed areas and about 250,000 acres in unsprayed areas in eastern parts of Gloucester, Northumberland and Kent Counties. The extreme hazard category, comprising so-called "grey areas", where serious fir mortality has occurred or is occurring, involved some 228,000 sprayed acres plus about 45,000 acres in unsprayed check areas. This condition is now largely beyond help from spraying except to delay the ultimate death of some trees and to prolong the salvage period.

Mortality in overmature balsam fir stands in the Kedgwick check area was nearly complete in 1957, seven years after the initial severe attack. This extreme condition was not typical of the entire check area, however; mortality computed for a full range of stand types and age classes was 33%. An almost identical estimate was obtained for the Charlo check area with the same infestation history. The following table compares results of a line-strip cruise in the

Charlo check area with data from a sprayed location on the Tobique, where spraying began in 1953 but was too late to prevent some tree-killing. Sample stands in both locations were all-aged, but with a heavy preponderance of stems in young age-classes up to about 6 inches b.h. Stand composition was over 90% fir. Spruce was mainly white, in scattered mixture, also with a full range of age classes represented.

It is evident from these data that the mortality in diameter classes below 6 inches has been almost equal in sprayed and unsprayed areas but that spraying has prevented or delayed mortality in the larger classes. This appears to be true for both fir and spruce.

PERCENTAGE OF TREES KILLED ON CHECK AREAS AND AREAS SPRAYED TOO LATE TO PREVENT MORTALITY

	Diameter class— inches b. h.						Total	
	2-3	4-5	6-7	8-9	10-11	12-13	By Stems	By Basal Area
BALSAM FIR								
Unsprayed.....	41	21	19	26	45	56	34%	30%
Sprayed.....	39	16	9	6	0	0	28	14
SPRUCE								
Unsprayed.....	29	9	12	4	7	8	16	9
Sprayed.....	24	11	0	0	0	0	9	2

Areas in which spraying appears to be warranted in 1958 to forestall further tree mortality total about 2.5 million acres, approximately equally divided between new areas of high hazard in York, Carleton, and Victoria Counties and previously sprayed areas in Victoria, Northumberland, Restigouche and Madawaska Counties. Plans are currently well advanced to treat this entire acreage.—F. E. Webb, D. R. Macdonald, and D. G. Cameron.

#### PRAIRIE PROVINCES

**Cuterebrids (*Cuterebra grisea* Coq.) Attacking Small Mammals.**—Two cuterebrids were collected in 1956 from small mammals during a population study of the latter in the Whiteshell Forest Reserve, Manitoba. They were identified as *Cuterebra grisea* Coq. by Dr. A. R. Brooks, Entomology Laboratory, Saskatoon. Dr. Brooks states that this species is the only member of the family that has been collected in the Prairie Provinces, so that it is likely that all the following records of cuterebrids pertain to the species *C. grisea*.

Of the two bots that were positively identified, one was a mature (third instar) larva which dropped from a specimen of *Peromyscus maniculatus bairdii* (Hoy and Kennicott) on September 13, 1956, while the mouse was being examined after capture in a live trap. The other was a late third-instar larva plucked from the epidermis of a specimen of *Microtus pennsylvanicus drummondii* (Audubon and Bachman) on August 4, 1956. Both mice were recaptured later and appeared to have suffered no ill effects from parasitism. Third-instar bot larvae have been noted on *Lepus americanus americanus* Erxleben, *Eutamias minimus borealis* (Allen.), *Synaptomys cooperi cooperi* Baird, *Phenacomys ungava ungava* Merriam, and *Clethrionomys gapperi loringi* (Bailey), but were not found on specimens from the orders Insectivora and Chiroptera. Several squirrels, ground squirrels, and jumping mice were examined and no bots were found, but this must be regarded only as indicative because of the sample size.

The two cuterebrids that were collected in 1956 were placed in covered jelly jars, to which a small portion of dampened sphagnum moss was added. They were held in the laboratory until October 15, when they were stored in a cold room held at approximately 7°C. On February 7, 1957, the temperature was raised to about 16°C., and both bots emerged in mid-March. The treatment afforded the two specimens is recorded in Table I.

TABLE I  
TIME TO EMERGENCE OF *Cuterebra grisea* Coq.

Host	Days at 16-24°C prior to cold treatment	Days at 7°C	Days to emergence at 16°C	Total number of days to emergence
<i>P. maniculatus</i> .....	32	115	34	181
<i>M. pennsylvanicus</i> ....	72	115	40	228

The incidence of third-instar bots found on small mammals has been recorded on three permanent plots from 1952 to 1957. They have been noted as early as June 16 and as



late as October 19. No relationship was evident between the peak bot population for any given year and the climatic conditions. The seasonal occurrence of cuterebrid bots is given in Table II. The peak bot population appears to coincide with that of its host.

TABLE II  
SEASONAL OCCURRENCE OF CUTEREBRIDS IN THE WHITESHELL FOREST  
RESERVE IN JUNE, JULY, AUGUST, SEPTEMBER, AND OCTOBER

Host	1952	1953	1954	1955	1956	1957
	J A S O	J J A S O	J J A S	J J A S O	J J A S O	J J A S O
<i>P. maniculatus</i> ....	1 3 1 0	0 1 6 0 0	1 3 0 0	1 0 3 0 0	0 1 8 2 1	1 0 5 0 1
<i>M. pennsylvanicus</i> ..	9 3 0 0	1 3 1 1 0	0 0 4 1	0 0 1 0 4	0 0 2 0 0	0 0 0 0 0
<i>C. gapperi</i> .....	1 4 0 0	0 4 6 2 0	0 0 0 0	0 0 1 5 1	0 0 0 0 0	0 0 0 0 0

No evidence of mortality due to parasitism by bots was recorded. Thirty-nine animals were recaptured after attack by third-instar bots and in no case was there any evidence of serious ill effects. There was however the suggestion of a loss in vitality of three of these shortly following the emergence of the bot larva and it is conceivable that these animals could be more readily attacked by predators than an animal that had not been infested.

Data are limited regarding the effect of bot parasitism on the survival of host progeny. On July 18, 1954, a female *M. pennsylvanicus* with a bot on the shoulder region gave birth to four young in a live trap. The young appeared normal in all respects, and when the female was released she moved the young to a burrow. On August 11, 1954, a pregnant *C. gapperi* with a bot on the inguinal region was captured and retained in the laboratory until parturition on August 14. The seven young appeared normal, but were destroyed by the mother within two days. This habit is not uncommon in captive *C. gapperi*.

Sillman (Ann. Rept. Ent. Soc. Ont. 86: 89-97: 1955; *Ibid.* 87: 28-40: 1956) has reported aspects of the ecology of cuterebrids in southern Ontario. Although this author was concerned chiefly with *C. angustifrons* Dal., some comparisons with these observations are of interest. Sillman reports third-instar larvae in the field from July 28 to September 15 whereas in the Whiteshell Forest Reserve this period has been extended over a month in either direction. Sillman considers that cuterebrids do not seriously affect mortality of the host except indirectly in new-born animals. The writer is of similar opinion except that there is evidence that even new-born animals are not seriously in hazard because of maternal infection. Sillman reports that *C. angustifrons* attacks *P. maniculatus* almost exclusively whereas *C. grisea* is probably less host specific. Neither *C. angustifrons* nor *C. grisea* has been recorded on shrews or jumping mice in Manitoba and Ontario. It is further suggested by Sillman that the pupal period of *C. angustifrons* is determined by soil temperatures. The pupal period of *C. grisea* is probably governed likewise, for the developmental period following cold treatment was similar to that reported by Sillman.—C. H. Buckner.

**Correction.**—In the article by O. Vaartaja entitled "Treating Seedbeds with the New Sterilizer Mylone", in Vol. 14, No. 2, page 3, the second last sentence of the third paragraph should read: "The 500-lb. rate of Mylone, however, caused a slight decrease in the numbers and a slight increase in the sizes of the seedlings."

#### BRITISH COLUMBIA

**The Current Status of Pole Blight in British Columbia.**—In British Columbia, the pole blight disease of western white pine (*Pinus monticola* Dougl. has been under continuous observation and investigation since it was first discovered in 1949. Early surveys and plot records indicated an alarmingly rapid intensification of the disease and heavy losses from mortality were anticipated. While these early fears were justified by the rapid progress of the disease on permanent sample plots up to 1953, more recently there has been a marked decrease in disease intensification. An improvement in stand condition has, in fact, been recorded on both disease progress and thinning plots and a similar trend has been observed in other pine stands. This trend now appears to have been sufficiently sustained to warrant a reappraisal of the potentialities of pole blight.

Progress of pole blight on the permanent sample plots was evaluated by rating each tree according to the degree of manifestation of its disease symptoms. These symptoms included reduced radial and leader growth, followed by yellowing, thinning, and stunting of the foliage. Long, narrow lesions accompanied by resinosis were also commonly found on affected trees. On the basis of symptom expression, plot trees were rated as healthy, early, intermediate, severe, or dead.

During examinations in 1953, it was noted that all plots, with the exception of the thinning plots at Arrow Park (Plot 456 B), showed a decrease in the rate of disease intensification when compared with previous years. Plot 456B did not show this reduction until 1954, at which time there was a slight over-all improvement in stand rating compared to 1953. By 1955, all plots showed a reduction in disease level, as evidenced by a decrease in the annual disease severity index (Fig. 1). This index, which is the weighted plot average of tree indices, as calculated by assigning each tree a value from 0 to 4 according to its classification as healthy, early, intermediate, severe, or dead. Prior to 1953, no improvement in individual trees was recorded and for many the rate of decline was rapid. Since then, although some trees have continued to decline, a larger proportion of the stand has shown a reduction in disease symptoms, resulting in a net improvement. On the Silverton thinning plot, for example, the number of healthy trees had dropped from 153 in 1950 to 19 in 1954, but by 1957 there had been an increase to 59 healthy trees (Table I). Similarly, the number of trees in the severe class on the same plot had dropped from 25 in 1954 to 16 in 1957 and during this period only one tree had died. It has also been noted in recent years that many affected trees, while showing no improvement, have declined no further. During the early years of pole blight observation, affected trees usually declined rapidly and frequently died shortly after reaching the severe stage. Similar trends in the redistribution of trees among severity classes occurred on all plots (Table I).

While the disease severity indices for all plots were lower in 1957 than in the peak years not all have shown a continuous reduction (Fig. 1). On Plots 456A and B (Arrow Park) there was a remarkable increase in the incidence of *Armillaria mellea* (Vahl ex Fr.) Quél. lesions at the root collar, the increase coinciding with a rise in the disease severity index of these plots. In 1957, 22 per cent of the live trees on Plot 456B had basal infections, twice the proportion recorded the previous year. The progress plots (456B) had an incidence of 17 per cent, which likewise was nearly double the previous year's incidence. The Silverton Plots (454A and B), on the other hand, where the index continued to drop, had a much lower incidence of 12 and 6 per cent respectively. While damage by *A. mellea* cannot be dissociated from the pole blight picture, the increase in index on Plots 456 A and B may be related to increased *Armillaria* activity, rather than to a reversal of the trend toward improvement.

One of the prominent features suggesting recovery of affected trees was an improvement in needle length, density, and colour. This improvement, first noted in a few trees in 1954, and which subsequently became fairly common, was apparent as a tufting of needles of nearly normal length and colour at the ends of branches which otherwise bore rather sparse, yellowed foliage. Such increases in foliage density at the ends of branches were distinct from the bunching of short, discoloured foliage, caused by a restriction of internodal growth characteristic of pole blight trees. This "recovery" foliage was observed even at the ends of almost bare branches. In other cases the leaders of trees in an advanced stage of decline had died back as much as 12 feet, but the foliage of the lower crown has since shown considerable improvement in colour and density. Initially such trees were confused with blister rust damage, but close examination failed to reveal trunk cankers. It was concluded, therefore, that they were pole blighted trees which had shown a remarkable degree of recovery. While the majority of "recovery" trees have maintained their improvement in vigour, some have suffered relapse, which is hardly unexpected when the complexity of the disorder is taken into account.

Further evidence indicative of the improved vigour of some trees is the healing of the elongate trunk lesions commonly associated with pole blight and the healing of basal lesions caused by *Armillaria mellea* infection. Healing of pole blight lesions was first observed on the plots in 1954, when two healing lesions were recorded. By 1957, a total of 56 were noted on the four plots. Healing lesions have also been observed in other stands. Such healing lesions were first noted as longitudinal cracks in the bark. On removal of the bark, callus formation was revealed along the margin of the lesion. Dissection in 1957 of some thirty of these lesions showed that healing in the majority of cases had begun during the period 1953 to 1957. In some cases, however, healing began as much as six years prior to dissection. Healing of basal lesions, caused by *Armillaria* infection also took place during the same period, although a number of older healed lesions dating somewhat further back were recorded. Healing basal lesions were more common on the Arrow Park than the Silverton Plots, as was the incidence of *Armillaria*.

Despite nearly nine years of investigation in British Columbia and observations and research which date back to



1938 in the United States, the cause of pole blight is still not clear. Precipitation and temperature records indicate that during the years 1940 to 1951 many summers have had below normal rainfall and above average temperatures. Since then, summers have been somewhat moister and cooler. The current reduction in the rate of disease intensification and the apparent improvement in vigour of some trees suggest that climatic cycles may have provided an underlying cause or predisposition for decline. While the present trend toward recovery or at least slower intensification may not be indefinitely maintained, it would seem probable that losses in the immediate future are unlikely to be as great as early observations had indicated. There would, therefore, seem to be some justification for reserving trees showing little or no evidence of damage. On the other hand, cutting of pine in moderate to severe stages of decline would appear expedient, for although early mortality of these trees is not anticipated, many may eventually succumb to such agencies as root rots and bark beetles. In any event trees in such a low state of vigour are not likely to put on much increment, for excavations have shown their root systems to have suffered considerable deterioration and rapid recovery cannot be anticipated. However, the remaining thrifty trees even in those stands having a high proportion of severe pole blighted trees would appear, under present conditions, to have as good a chance of continued growth as thrifty trees in less heavily damaged stands.

Reconnaissance surveys in British Columbia have shown that pole blight damage ranges from nil to very heavy mortality of white pine. Surveys in the United States have

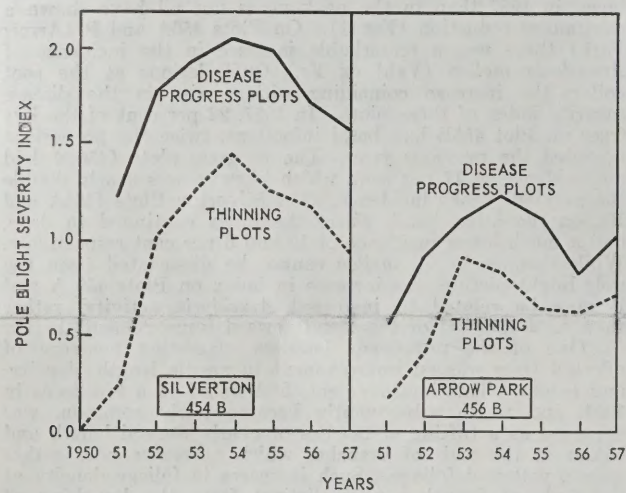


Fig. 1. The development of pole blight on permanent sample plots in British Columbia.

indicated some correlation between pole blight incidence and soil moisture storage capacity. However, present knowledge of the environmental factors differentiating sites with varying degrees of damage is not sufficient to predict adequately the susceptibility of any given site. It will be necessary to continue investigation of environmental and site relationships in order to assign satisfactory hazard ratings to different stands, if white pine is to be managed with due regard to the potentialities of pole blight in the future.—A. C. Molnar and R. G. McMinn.

TABLE I. POLE BLIGHT DEVELOPMENT ON DISEASE PROGRESS AND THINNING PLOTS AS SHOWN BY ANNUAL DISTRIBUTION OF TREES IN DISEASE SEVERITY CLASSES

Disease severity class	Number of trees in severity class by year							
	1950	1951	1952	1953	1954	1955	1956	1957
Silverton disease progress plot (454 A)								
Healthy.....	58	33	20	18	17	25	27	
Early.....	45	26	36	29	36	32	35	
Intermediate.....	31	48	35	30	22	28	32	
Severe.....	24	45	53	60	54	42	29	
Annual dead.....	6	6	8	7	8	2	4	
Accumulated dead.....	6	12	20	27	35	37	41	
Arrow Park disease progress plot (456 A)								
Healthy.....	182	135	99	90	85	122	83	
Early.....	53	58	82	74	103	92	113	
Intermediate.....	38	65	68	65	49	33	42	
Severe.....	11	24	28	43	30	15	20	
Annual dead.....		2	5	5	5	5	4	
Accumulated dead.....		2	7	12	17	22	26	
Silverton thinning plot (454 B)								
Healthy.....	153	123	44	34	19	31	40	59
Early.....	3	29	73	67	72	73	72	60
Intermediate.....		4	38	34	40	32	20	20
Severe.....			11	21	25	20	23	16
Annual dead.....							1	0
Accumulated dead.....							1	1
Arrow Park thinning plot (456 B)								
Healthy.....	216	163	95	104	125	131	119	
Early.....	21	60	93	95	82	75	76	
Intermediate.....	8	22	42	30	25	25	30	
Severe.....			14	11	7	5	9	
Annual dead.....			1	4	1	3	2	
Accumulated dead.....			1	5	6	9	11	

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O. H. M. S.

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